

REMARKS

Claims 1-19 are all the claims pending in the application.

Formal Matters

1. Applicant respectfully requests that the Examiner acknowledge Applicant's claim to priority and the priority documents filed on March 26, 2001.

2. Applicant has amended independent claims 1, 3, 6 and 8 and submits that no new matter has been added. Support for the amendments can be found at least on pages 8-10 and 13.

Art Rejections

1. Claims 1-10 and 13-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitahara et al EP 0827838 ("Kitahara") in view of Barbehenn et al. U.S. Application No. 5,363,134 ("Barbehenn"). Claims 1, 3, 6 and 8 are all independent claims. Applicant respectfully traverses this rejection for at least the reasons stated below.

Independent Claim 1

Kitahara fails to disclose, teach or suggest at least the following limitations of independent claim 1:

providing a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice;

applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices;

measuring amounts of the respective liquid droplets jetted by the reference drive signal;

identifying a difference between the designated amount and the measured amount of each liquid droplet;

In a non-limiting embodiment of the present invention, drive signals are capable of jetting a liquid droplet having a volume smaller or larger than the required or designated liquid volume of a reference drive signal. Specifically, a reference drive signal is provided such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice. The liquid droplet is jetted from the nozzle orifice upon application of the reference drive signal. The amount of liquid jetted by the reference drive signal is measured, and the difference between the designated amount of liquid and measured amount of liquid is compared. Correction data is then used to reduce the difference, and the displacement of the piezoelectric vibrator is adjusted as such.

Applicant respectfully submits that Kitahara fails to disclose, teach or suggest at least measuring the amount of liquid droplets jetted by the reference drive signal, not to mention, identifying the difference between the designated amount and the measured amount of each liquid droplet.

The Examiner concedes that Kitahara fails to disclose, teach or suggest providing ID data for identifying a respective nozzle orifices. The Examiner therefore relies on Barbehenn to fulfill at least this deficiency.

Barbehenn is directed to an integrated circuit for use in an ink jet printer which includes an array circuit for heating an ink reservoir to produce a pattern of ink jets. Barbehenn, however, fails to disclose, teach or suggest measuring the amount of liquid droplets jetted by the reference drive signal and identifying the difference between the designated amount and the measured amount of each liquid droplet.

Without at least such a suggestion, one would not have been (and could not have been) motivated to combine the ink jet printing method, as disclosed in Kitahara, with the integrated circuit printhead, as taught in Barbehenn, to produce the claimed subject matter. Because there can be found in Barbehenn no teaching or suggestion that meets the above-identified limitations, the combination of Kitahara and Barbehenn cannot reasonably be said to render obvious the claimed subject matter. The Examiner is therefore respectfully requested to withdraw the § 103(a) rejection from independent claims 1, 3, 6 and 8 and the claims that depend therefrom.

Independent Claim 3

Since claim 3 contains features that are similar to the features discussed above in conjunction with independent claim 1, Applicant submits that claim 3 and its dependent claims are patentable for at least such reasons.

Independent Claim 6

Since claim 6 contains features that are similar to the features discussed above in conjunction with independent claim 1, Applicant submits that claim 6 and its dependent claims are patentable for at least such reasons.

Independent Claim 8

Since claim 8 contains features that are similar to the features discussed above in conjunction with independent claim 1, Applicant submits that claim 8 and its dependent claims are patentable for at least such reasons.

2. Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitahara et al EP 0827838 ("Kitahara") in view of Barbehenn et al. U.S. Patent No. 5,363,134

Amendment Under 37 C.F.R. § 1.111
U.S. Appln. No. 09/816,770

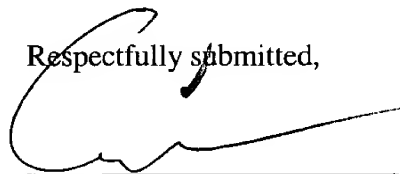
("Barbehenn") in regards to claim 8, and in further view of Bain U.S. Patent No. 4,521,786 ("Bain").

Claim 11 depends from independent claim 8. Kitahara and Barbehenn are deficient with respect to claim 8 for at least the reasons stated above. Furthermore, since Bain fails to compensate for the foregoing deficiencies, Applicant submits that claim 11 is patentable at least by virtue of its dependency. The Examiner is therefore respectfully requested to withdraw the § 103(a) rejection from independent claim 11 and the claims that depend therefrom.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Grant K. Rowan
Registration No. 41,278

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE



23373

PATENT TRADEMARK OFFICE

Date: December 2, 2002

APPENDIX ✓

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) A method jetting liquid droplets, comprising the steps of:

providing a liquid jetting head which includes: a plurality of nozzle orifices; a plurality of pressure generation chambers associated with the nozzle orifices; and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifice;

providing ID data for identifying the respective nozzle orifices;

providing a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice;

applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices;

measuring amounts of the respective liquid droplets jetted by the reference drive signal;

identifying a difference between the designated amount and the measured amount of each liquid droplet;

providing correction data for [correcting]reducing the difference; and [amount of liquid jetted from the identified nozzle orifice:]

adjusting a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the correction data.

3. (Amended) A method of jetting liquid droplets, comprising the steps of:

providing a liquid jetting head which includes: a plurality of nozzle orifices; a plurality of pressure generation chambers associated with the nozzle orifices; and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifice;

setting a single jetting cycle as a period in which N drive signals are applicable to the piezoelectric vibrators to jet liquid droplets from the nozzle orifices, N being an integer;

providing ID data for identifying the respective nozzle orifices;

providing a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice;

applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplets from the nozzle orifices;

measuring amounts of the respective liquid droplets jetted by the reference drive signal;

identifying a difference between the designated amount and the measured amount of each liquid droplet;

providing correction data for[correcting] reducing the difference;[amount of liquid jetted from the identified nozzle orifice]

selecting M drive signals from the N drive signals based on the correction data, M being an integer which is equal to or less than N; and

applying the M drive signals to the piezoelectric vibrators within the single jetting cycle.

6. (Amended) A liquid jetting apparatus, comprising:

a liquid jetting head including: a plurality of nozzle orifices; a plurality of pressure generation chambers associated with the nozzle orifices; and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifice;

a drive signal generator, for generating a plurality of drive signals, respectively driving the piezoelectric vibrators, within a single jetting cycle of the liquid jetting head;

an ID data storage, for storing ID data which identifies the respective nozzle orifices;

a reference drive signal generator, for generating a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice;

a reference drive signal applier, for applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices;

an identifier, for measuring amounts of the respective liquid droplets jetted by the reference drive signal, and identifying a difference between the designated amount and the measured amount of each liquid droplet;

a correction data storage, for storing correction data which [corrects] reduces the difference; [amount of liquid jetted from the identified nozzle orifice;] and

a drive signal supplier, for selecting at least one drive signal from the plural drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the correction data.

8. (Amended) A liquid jetting apparatus, comprising:

a liquid jetting head including: a plurality of nozzle orifices; a plurality of pressure generation chambers associated with the nozzle orifices; and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifices;

at least one drive signal generator, for generating N drive signals, respectively driving the piezoelectric vibrators, within a single jetting cycle of the liquid jetting head, N being an integer which is not less than 3;

an ID data storage, for storing ID data which identifies the respective nozzle orifices;

a reference drive signal generator, for generating a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice;

a reference drive signal applier, for applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplets from the nozzle orifices;

an identifier, for measuring amounts of the respective liquid droplets jetted by the reference drive signal, and identifying a difference between the designated amount and the measured amount of each liquid droplet;

a correction data storage, for storing correction data which [corrects] reduces the difference [amount of liquid jetted from the identified nozzle orifice]; and

a drive signal supplier, for identifying a nozzle orifice in which the jetting amount is to be corrected, through use of the ID data, and selecting M drive signals from the N drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the correction data, M being an integer which is equal to or less than N.